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**(54) An Electronic Lock for Suit-cases, or the Like**

(57) An electronic lock and key for suit-cases, trunks, and the like, said key being formed by a decoder circuit and a binary comparator, and said lock being formed by an oscillator and a decoder circuit, this system providing thousands of different combinations as pre-programmed by means of the two electronic circuits. The key is provided with plug elements to be

inserted into suitable sockets in the lock, and is provided with a push-button to actuate a circuit which generates a reset pulse effective to clear two counters. There is an oscillating circuit and inverters which generate a square wave, which from the time at which the reset inputs of the counters return to "zero", causes the multiple stage binary counters to count up, at the outputs of the counters which are set for the code number for unlocking said lock.

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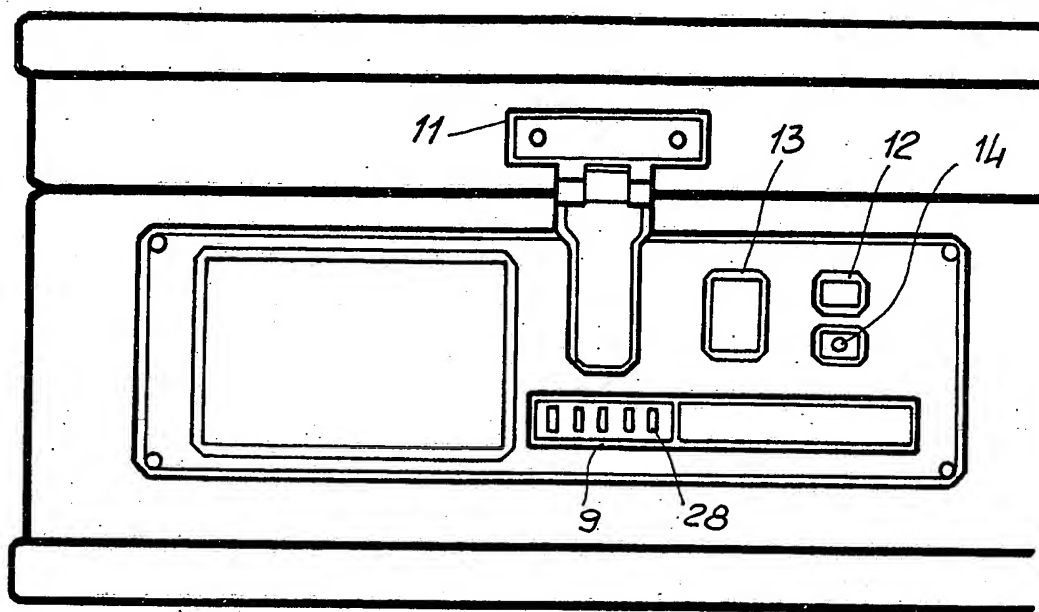
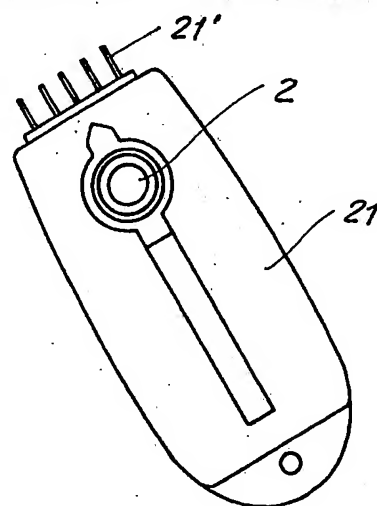
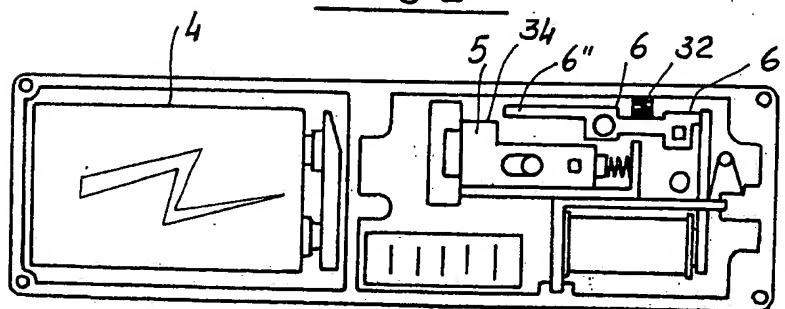
Fig. 1Fig. 2

Fig. 3

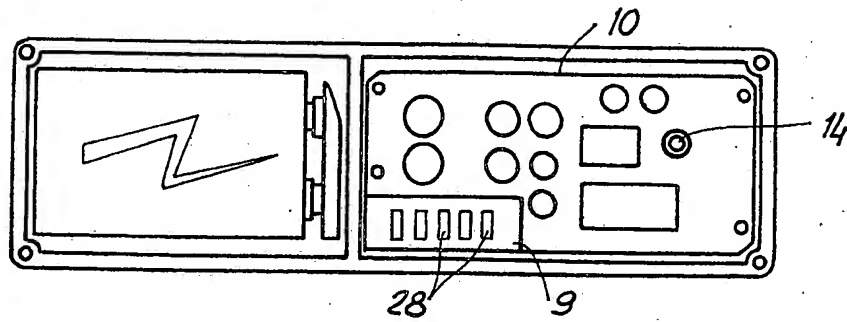


Fig. 4

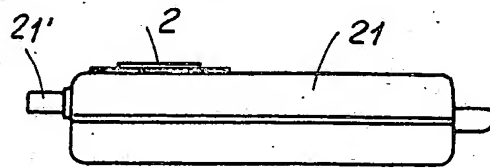


Fig. 5

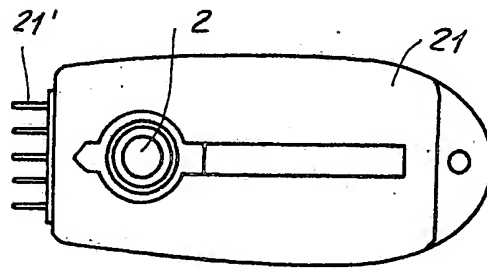
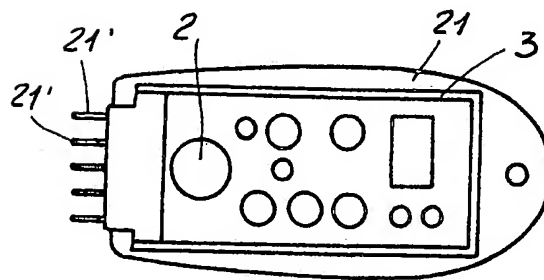


Fig. 6





## SPECIFICATION

## An Electronic Safety Locking Device for Suit-cases, Trunks, or the Like

5 The present invention relates to an electronic locking device the operation thereof is based on the principle of combining the electronic-counting number, as generated in a device representing an electronic key, and the corresponding electronic-counting number of a device contained in a safety

10 locking system.  
As it is known, the safety locking devices are made by means of conventional mechanic systems or by numerical combination locking elements, which may be partly opened, or un-  
15 locked, which require mnemonic efforts by the user and which are difficult to be used in the case of poor visibility and as the user has a rather bad sight.

20 The aforesaid drawbacks are, on the contrary, eliminated by the use of the device according to the present invention.

In fact, by using the instant safety locking device particularly for suit-cases and the like, the mechanism for using an especially provided  
25 electronic key does not require any particular expedient, since it is sufficient to merely plug-in said key in the circuit applied to the suit-case or the like, by an operation which is completely like to that of inserting a plug into the  
30 related socket.

Furthermore, for each connector type or model are possible thousands of different electronic combinations, thereby being possible to obtain  
35 numberless combinations, simply by passing from a series to the next one, merely replacing the connectors located respectively on the key and on the lock.

Each electronic key may be provided with a matriculation code, printed on the lock itself,  
40 thereby permitting to obtain key duplicates in a loss case.

The locking and un-locking operations of the suit-case may also be carried out manually, as in the conventional types of suit-cases, and,  
45 furthermore, they may be carried out by operating a small plug-in lever associated to the electronic safety locking device, which lever prevents any attempt of unlocking said lock, unless the corresponding electronic key is used.

50 Since said electronic key is operated or actuated by an electric battery therein contained, in order to prevent said battery from discharging, said electronic key is provided with a signalling light, effective to signal to a user the discharged  
55 condition of said battery for the replacing.

The electronic safety locking device according to the present invention, is based on the simultaneous electronic-counting principle performed by two binary electronic counters each  
60 driven by an oscillator located in the lock mounted on the suit-case, and by an electronic circuit contained in said electronic key.

Said electronic counting is simultaneously started in the two pulse counters, by pressing

65 down the push-button the electronic key is provided with.

At the end of the counting as predisposed or set in each said counters, said electronic counting is ended and only if the two counters end the  
70 count on the same digit, is actuated the circuit driving the coil for unlocking the lock.

The aforesaid different counting combinations are obtained by using two binary counters, for example of the 14-stage type which are able to  
75 count up to  $2^{13}$ .

At the outputs of the counters, by means of two diodes, a digit is set corresponding to the lock  
80 unlocking code, that is to the number of pulses which the counters have to count, before allowing for said lock to unlock.

If the two diodes are inserted in the analogous positions of the two counters, at the time at which the outputs will be of positive value, the  
85 counting up of said two counters is stopped by means of an inverter, and a transistor goes to its saturation state thereby pulling the keeper and permitting said lock to open.

As for unlocking said lock one uses a key which is different from that supplied with the lock, then  
90 two cases may occur:

1) the key combination has a number greater than that of the lock; in this case as the key preset output becomes positive, the transistor does not  
95 pass to saturation since it is held at 0 by counter; 2) the key combination has a number less than that of the lock; the reasoning is similar to the preceding one, since, also in this case, said transistor does not saturate, being held at zero by the key counter.

100 The device according to the present invention and the operative and structural characteristics thereof will become more apparent from the figures of the accompanying drawings, in which:

Figure 1 is a top view illustrating a suit-case or  
105 trunk provided with a safety electronic lock, consisting of an electronic circuit, which is actuated by an electronic key in turn comprising a corresponding driving circuit;

Figure 2 is a side cross-section illustrating the  
110 electromechanic lock to be applied to suit-cases, trunks and the like, according to the present invention;

Figure 3 is another cross-section view illustrating that same lock, in which are shown the  
115 multiple socket for plugging-in said electronic key, a locking electronic transistor panel and a signalling light, effective to signal the unlocking of said lock and the discharged condition of the battery as, with the lock in an unlocked condition,  
120 said light does not wink;

Figures 4, 5 and 6 are respectively side, front and cross-section views, illustrating an electronic  
125 key, in said cross-section view being furthermore represented the driving electronic transistor panel included in said key;

Figure 7 illustrates an exemplary detailed electronic diagram of the instant locking device; and

Figure 8 illustrates, by a block diagram, the

operating principle of the electronic safety locking device according to the invention.

Referring particularly to the numbers of the several figures of the accompanying drawings, the electronic safety locking device according to the invention comprises a mechanic part and an electronics part, this latter being divided and distributed in a key (21) and a lock (22), said key (21) comprising a decoder and a binary comparator while said lock comprises an oscillator and a decoder.

This system is able of permitting the carrying out of numberless different combinations, as pre-programmed in the two electronic circuits during the making step.

Said two electronic circuits are preferably formed on a fiber glass support being provided with electrolyte copper paths and tin-lead pattern.

All the components are of the solid state type, and the integrated circuits are of the "CMOS" type, the discrete components being of the silicon type.

The schematic diagram is illustrated in figure 8 where (23) indicates an oscillator, (24) a code, (25) an encoder, (26) a decoder and (27) a code.

The operation of the instant electronic safety locking device provides for the using of a key (21) having a plurality of plugs (21') which are inserted into corresponding sockets (28) forming a connector (1).

As it is shown in Figure 7, by pressing down the aforesaid push-button (2), upon having inserted the key (21) into the sockets (28), the circuit "R/I", "C/I", generates a reset pulse clearing the two counters "M/I", "M/2".

Simultaneously the oscillating circuit formed by "R/2", "R/3" and "C/2" and by the inverters "I/I", "I/2" and "I/3" starts to generate a square wave which, at the same time at which the reset inputs of the counters return to "zero", causes said counters to count up. Said counters are two multiple-stage binary counters effective to provide very high counts.

At the output of said counter, through the diodes "D/I" and "D/2" a digit is set provided for constituting the unlocking code of the lock, that is the number of the pulses which have to be counted by said two counters, before permitting said lock to unlock.

If the two diodes are inserted on the analogous positions of the two counters, at the time at which both the outputs thereof pass to the 1-state, through the inverter "I/4", the clock to the two counters is disabled, and the transistor "T/I" will saturate, thereby causing the transistor "T/2" to pass to the off state, which transistor "T/2" will in turn saturate the transistor "T/3" thereby energizing the coil (8) which will pull up the keeper (7), in such a way as to remove the impediment to the unlocking of the lock due to the presence of the keeper (6).

As for unlocking the lock one uses a key different from that supplied with the lock, two cases may occur:

1°) the key combination has a number greater

than that of the lock: in this case as the output preset by the counter "M/2" goes to "1", the transistor "T/I" will be not driven, since it will be held at "zero" by the counter "M/I";

2°) the key combination has a number less than that of the lock; the reasoning is similar to the preceding one, with the exception that this time will be the counter "M/I" to firstly pass to "1" and "M/2" to hold in an off condition the transistor "T/I".

The combinations which may be obtained, for example, may be given by  $2^{13} + 2^{12} + \dots$   $2^3 + 2^0 = 8186$  times the possible combinations due to the five contacts of the connector. If, due to safety reasons, the positions of the two power supply terminals are not varied, then the remaining three terminals provide six possible combinations, which, multiplied by the preceding combinations, provide a possibility of making 49116 different combinations.

In order to permit to monitor the battery status, in parallel to the driving coil "8" a "LED" (14) diode has been connected. Said "LED" will turn on each time the lock is operated, and only as the battery voltage will drop for example under 6V said LED will be off due to the Zener diode series connected with respect to said LED. In this case the lock will be capable of operating, but the user will know that the battery has to be replaced.

The electronic safety locking device according to the invention comprises furthermore a battery (4) effective to supply current to the coil of an electromagnet (8), which is able of exercising a pulling action on the end (7') of a keeper (7) able of oscillating on a pivot (38), a spring (31) biasing said keeper (7) against the end (6') of said lever (6) as said electromagnet is disenergized.

The aforesaid lever (6) may swing on the pivot (33), and is provided with a spring (32) biasing upwardly the end (6") of said lever (6) and biasing downwardly the end (6') thereof.

The instant device comprises furthermore an opening and closure sliding element (5) in turn provided with a top ridge (34) thereagainst abuts the end (6") of said lever (6).

As said sliding element is in a locked condition, it presents the locking member (22) from unlocking, said locking member being pivoted to a fixing member (11).

The plugging in of the device for locking said sliding element (5) is obtained by the push-button (12) effective to upwardly slide, in such a way as to upwardly move the end (6') of the lever (6), while the end (7') of the keeper (7), by moving under the end (6') of the lever (6), prevents this latter from sliding the unlocking and locking sliding element (5).

The unlocking of the instant device is obtained by inserting the key (21) in the multiple socket (9) which is electrically connected to the electronic transistor panel of the lock (10) which panel provides the power supply to the electromagnet (8).

This latter, by pulling the end (7') of the keeper

(7), causes the end (6') of the lever or keeper (7) to lower and hence the sliding element (5) and locking member (22) to unlock.

The instant device also comprises an electronic key (21) provided with a plug-in type of multiple connector (1) including a plurality of plug elements (21) to be inserted into corresponding sockets (22) formed in a multiple socket (9) for the key.

The aforesaid electronic key (21) is also provided with an electronic transistorized panel (3) which, jointly to the electronic transistorized panel (10) included in the locking device proper, is effective to drive the mechanical part of the lock for unlocking said lock.

It should be noted that the electronic safety unlocking device according to the invention has been thereinbelow described and illustrated only as a non limitative example.

Accordingly, to the electronic safety unlocking device according to the invention modifications and variations may be brought without departing from the invention scope.

#### Claims

1. An electronic safety locking device for suitcases, trunks and the like, characterized in that it comprises an electronic apparatus subdivided and distributed in a key and a lock, said key being formed by a decoder circuit and a binary comparator, and said lock being formed by an oscillator and a decoder circuit, said system being effective to permit to obtain thousands different combinations as preprogrammed by means of said two electronic circuits.

2. An electronic safety locking device for suitcases, trunks and the like, according to claim 1, characterized in that said key is provided with plug elements and is effective to be inserted into suitable sockets, being provided with a push-button effective to actuate a circuit (R/1), (C/1) which generates a reset pulse effective to clear the two counters (M/1) and (M/2).

3. An electronic safety locking device according to the preceding claims, characterized in that said device is provided with an oscillating circuit or oscillator, formed by (R/2), (R/3) and (C/2) and by the inverters (I/1); (I/2) and (I/3) and effective to generate a square wave, which form the time at which the reset inputs of said counters return to "zero", causes said multiple stage binary counters to count up, at the outputs of said counters, through diodes (D/1), (D/2), being set the code number for unlocking said lock.

4. An electronic safety locking device according to the preceding claims, characterized in that said device is provided with two diodes effective to be inserted or connected in the analogous portions of said two counters, in such a

way that at the time at which both said outputs go to the 1-condition, the clock to said two counters is disabled by means of an inverter (I/4).

5. An electronic safety locking device, according to the preceding claims, characterized in that it comprises a transistor (T/1) effective to pass in saturation thereby causing another transistor (T/2) to switch off, said transistor (T/2) saturating a further transistor (T/3) thereby energizing a coil, provided with a keeper for unlocking a lever (6).

6. An electronic safety locking device according to the preceding claims, characterized in that said device comprises a LED diode (14) connected in parallel to the driving coil (8) and series connected with respect to a ZENER diode.

7. An electronic safety locking device, according to the preceding claims, characterized in that it comprises a battery (4) effective to current supply a coil of an electromagnet (8), effective to pull in the end (7') of a keeper or lever (7) swinging on a pivot (30) and provided with a spring (31).

8. An electronic safety locking device, according to the preceding claims, characterized in that said device is formed by a lever (6) swinging on a pivot (33) and provided with a spring (32) and effective to engage with an unlocking and locking sliding element (5), provided with an upper ridge (34) thereagainst the end (6'') of said lever (6) abuts.

9. An electronic safety locking device according to one or more preceding claims, characterized in that said sliding element (5) is effective to engage with a locking member (22) pivoted to a fixing member (11).

10. An electronic safety locking device according to one or more of the preceding claims, characterized in that said device is provided with a device effective to lock said sliding element (5), which device may be operated by a push-button (12) effective to upwardly slide and connected to said end (6') of said lever (6).

11. An electronic safety locking device according to one or more of the preceding claims, characterized in that said device is provided with a key (21) effective to be inserted into a multiple socket electrically connected in an electronic transistor panel of said lock (10), and effective to enable the power supply for said electromagnet (8).

12. An electronic safety locking device according to the preceding claims, characterized in that it comprises a plurality of electronic circuits and mechanic members, as broadly described and illustrated in the preceding description and several figures of the accompanying drawings, constituting an integrating part of the present Patent Application.